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Patentanmeldung Nr. | Patent application No. | Demande de brevet n°

99104944.6

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Applicant(s):
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Flat bed platesetter system and method for its use

Background of the invention

1. Field of the invention

The present invention relates to a system and method for imaging a modulated light beam across thermosensitive or photosensitive printing plates of various rigidities, without limitation of the format, commonly known as platesetters. In particular, it is directed to flat bed platesetters directly imaging images onto the thermosensitive or photosensitive plates or surfaces of printing plates.

2. Description of the prior art

Usually, in known multibeam devices allowing the exposition of thermosensitive printing plates, the plate which is necessarily flexible is disposed on the exterior of a cylinder according to the principles described in US-A-4 819 018 (Moyroud et al.). These devices allow the exposition of large formats but the handling of the printing plate for its accurate setting and its takedown are complex, slow and may necessitate a "straightening" operation as explained in US-A-5 699 740. This handling is considerably simplified in flat bed devices.

Among flat bed machines, photocomposers have been constructed and described, e.g., in US-A-4 746 942 (Moulin) with mobile heads including a LED column for exposing the film moved with

the help of drive belts. This drive type does not allow to position the images with precision and reproducibility on the plate.

There are photoplotters which include a head with interlaced LED columns in two directions over a photosensitive plate, fixed on a heavy table. The head moves in the direction perpendicular to the column. In the other direction, both the head and guidance must be moved, which represents a large mass and consequently allows only a slow movement.

Another device based on essentially the same configuration type is described in British Patent Application No. 2 299 728 (Neilson et al.). This device is able to scan a light beam across the photosensitive surface of a printing plate on a bed. It comprises a bridge that extends across the bed from one side to the other and is supported at each end on a carriage guided along a respective one of the sides of the bed. A scanning head is supported on the bridge. Drive means and position location means are located at each end of the bridge, and control means control the operation of each drive means in accordance with position information. The device is located above a storage for plates, and means are provided for selecting plates of the desired size and feeding them upwards, and then on an air layer to a location in contact with stops.

Other flat bed devices use a laser beam deviated by a rotating mirror. The scanning size of a deflection device is limited. For larger formats, a device utilizes several adjacent deflection systems.

For the exposition of thermosensitive printing plates, the machines using a deflection device apply a YAG laser pumped by thermostabilized laser diodes and an acoustic and optical

modulator. Besides the high costs, these devices are limited in power and modulation frequency, which does not satisfy the purposes of the present invention.

The multibeam devices do not show these limitations. If each of these beams is produced by an individually controlled emitter, the number of beams is limited due to economic reasons, e.g., to 64. For achieving the desired performance, the printing plate should move at more than about 5 m/s. This speed can only be obtained on machines having an exterior cylinder. For a flat bed device, several hundreds of beams are necessary and therefore, the use of a spatial modulator as described, e.g., in US Patent No. 4 746 942 (Moulin) is necessary. In this document, the laser is fixed at a location remote from the device.

The power at the exit of the head and the number of spots, e.g. 256, is more appropriate for a flat bed device in which the printing plate has to move in start-and-stop fashion during the several inversions of the moving direction of the optical head. The distance between the printing plate and the projection objective should preferably be within a tolerance of 50 µm. The solution of fixing the sensitive printing flat on a very flat table which moves in start-and-stop fashion is inapplicable in a high speed platesetter system due to the long time these movements take on account of the large inertia, which is an important feature of these devices.

Summary of the invention

It is therefore an object of the present invention to provide an improved flat bed platesetter and an improved method for its use which is in particular designed for directly imaging onto a thermosensitive or photosensitive surface of a printing

plate. This object is achieved with the flat bed platesetter system according to the present invention and a method for its use as indicated in the respective claims.

In the flat bed platesetter according to the present invention, a radiant energy emitting head moves transversely to the direction of movement of a printing plate which is sensitive to the respective radiant energy. The radiant energy, for example, may be provided by visible light, infrared radiation, ultraviolet radiation and any other radiation being able to form an image on a printing plate. Preferably, the optical head includes a spatial modulator which is illuminated by laser emitters and an optical assembly which forms the image of the modulator on the printing plate level. This image forms columns of spots, whose intensities are individually controlled by the modulator. The printing plate is movably supported on at least one low inertia carriage member effectively connecting the printing plate and drive means. This connection may be achieved, for example, by at least one vacuum gripper holding the printing plate. Accordingly, the platesetter system has two carriages or slides of about the same mass timed to move alternatively along perpendicular paths. A plate-driver sliding carriage is moving along the long dimension of the plate and preferably at its centre, and a head-driver sliding carriage is moving in a crosswise direction. The plate-driver slide is operated during the dwell period of the head-driver slide while it slows down, reverses, accelerates and reaches its cruising speed in the opposite direction. Advantageously, an interlocking circuit prevents the motion of one carriage before its electronic control has received the appropriate signal from the other carriage control. Of course, the timing can be adjusted for plates of different sizes and/or sensitivities and for heads of different radiant intensities. Preferably the printing

plate is automatically positioned on a support area irrespective of its shape and afterwards fixed on the carriage member. For stepwise feeding the printing plate relative to the optical head, preferably an electric linear motor is provided.

Generally, the invention is more applicable to rigid or semi-rigid metal printing plates. According to the invention the plate itself is moved for spacing exposed swathes at the end of each exposing head excursion. No heavy plate-supporting carriage is involved. The plate can slide freely on an assembly of roller-bearings defining a flat plate-supporting surface. The plate can be indexed quickly following each crosswise scan during the dwelling period of the exposing head carriage because of the very low inertia of the components set in motion for swath spacing.

The flat bed platesetter system and the method for its use according to the present invention have in particular the advantages that they combine simplicity, reliability, velocity and precision. This precision in particular allows the exact imaging of four printing plates to be used in four-colour printing machines. Furthermore, the increased precision and velocity of the system according to the present invention are important advantages over known devices. This can be achieved particularly because of the use of movable elements having a low inertia. Generally, the present invention relates to a multibeam flat bed device with a sensitive support moving, e.g., 5 mm in less than 80 ms with formats of 1.5 m x 2 m and with a precision in the range of about 1-2.5 µm to reduce banding. Additionally, the non-productive time between exposition of two plates can be reduced to only a few seconds. The power obtained on the level of the incident radiant energy on the printing plate can be over 20 W for certain

applications, such as the exposition of thermosensitive offset printing plates having large dimensions, e.g. for the production of advertizing posters.

Brief description of the drawings

In the drawings, preferred embodiments of the invention are shown by way of illustration and not limitation.

Fig. 1 represents an overall view of the flat bed platesetter system according to the present invention.

Fig. 2 is a cross-sectional view through the system of Fig. 1.

Fig. 3 is a cross-sectional view along line 3-3 of Fig. 2.

Fig. 4 is a schematic side view of the low inertia carriage member incorporated in the system of Fig. 1.

Figs. 5 shows one embodiment of an optical head which may used in the system according to the present invention.

Figs. 6 to 11 represent the method steps for imaging a printing plate by means of a system according to the present invention, wherein each of these Figures schematically show side views (Figs. 6a to 11a) and top views (Figs. 6b to 11b) of the system.

Description of the preferred embodiments

Fig. 1 represents an overall view of the flat bed platesetter system 2 according to the present invention. The system 2 has a support area 4 supporting a printing plate 6 to be imaged. Preferably, the support area 4 comprises several longitudinally arranged linear bearings 8 movably supporting the printing plate 6 in a direction of movement indicated by arrow 10. The linear bearings 8 are preferably cylindrical rollers as best illustrated in the cross-sectional view of Fig. 2. Said linear bearings 8 may be, for instance, obtained from Interroll. However, also any other type of linear bearings movably supporting the printing plate 6 may be used.

The support area 4 has an upstream end 12, which is preferably connected to a storage or delivery system (Fig. 6) for storing and delivering printing plates to be imaged. This storing and delivery system 14 may be arranged, e.g., adjacent, below, above or remote from the flat bed platesetter system according to the present invention. It may be configured to automatically deliver required printing plates to the support area 4 of the platesetter system 2. However, although the automatic system may be advantageous, it is also possible to manually deliver the printing plates 6 to the support area 4. The support area furthermore comprises positioning means to properly position the printing plate 6 on the support area 4. As illustrated in Fig. 1, the positioning means comprises at least one positioning element 16 and 18 at each lateral side of the support area 4, and at least one stop element 20 at a downstream end of the support area 4. The lateral positioning elements 16 and 18 are preferably movable in a direction transverse to the direction of movement 10 of the printing plate 6. The stop element 20 is preferably movable in a

vertical direction so as to allow movement of the printing plate along the direction of movement 10 or to block it. It is preferable to have only one positioning element 18 at one lateral side of the printing plate and two positioning elements 16 spaced apart from each other at the opposite lateral side. This configuration particularly allows a proper and defined position of the printing plate on the support area 4.

It is furthermore preferable to provide precision linear bearings 24 instead of the conventional linear bearings 8 at a downstream end 22 of the support area 4. An enlarged cross-sectional view of the precision linear bearing 24 is illustrated in Fig. 3. The precision linear bearing 24 may comprise small precision rolls having a tolerance of ± 50 μm with respect to a reference surface 26. Furthermore, ducts 25 may be provided within the precision linear bearings 24. These ducts 25 are preferably connected to a vacuum source (not shown) in order to provide a vacuum pulling the printing plate 6 precisely onto the rolls of the bearings 24 so as to ensure that the focus of the radiation emitted from the optical head is located adequately on the printing plate 6.

For moving the printing plate 6 along the support area 4, a drive assembly 28 is provided, which is generally referred to with reference sign 28. The drive assembly can best be seen in the cross-sectional view of Fig. 2 and the longitudinal view of the drive assembly in Fig. 4. The drive assembly 28 is preferably provided only to transport the printing plate 6 out of the initial position provided by the positioning means 16, 18 and 20 along the direction of movement 10 for imaging the printing plate. The drive assembly 28 is essentially characterized by its low inertia and high precision. The mass of the movable parts of the drive assembly 28 including the

printing plate 6 is, for example, only 4 kg. Preferably, the drive assembly 28 is provided in a centre position of the support area 4 along the path of movement. This reduces the tendency of developing a torque upon acceleration or deceleration tending to rotate the plate because of its inertia.

The drive assembly 28 is carried by a support member 30 being itself supported together with the support area on a frame 32 which is preferably inclined in the direction of movement 10. The support member 30 may be, for instance, a rectangular tube fixedly holding the stationary elements 34 of a linear bearing 36 movably supporting a sliding bar 38 holding the printing plate 6. The linear bearing 36 may be one available from Sferax Swiss. The slide bar 38 is longitudinally movably connected to the bearing 36 by means of movable bearing elements 40 moving on the stationary bearing element 34 of the linear bearing 36. It is preferable that two rows of linear bearings 36 are provided on the support element 30 to precisely and safely guide the slide bar 38 carrying the printing plate 6. Although the embodiment illustrated in Fig. 2 shows two fixed bearings, it is also possible to provide a fixed and a movable bearing.

For driving the slide bar 38 together with the printing plate 6 relative to the frame 32, an electric linear motor 42 is provided. The linear motor 42 may be of the type LEB-S-2-S available from Anorad USA. The linear motor 42 works according to the stator-rotor principle having a fixed element 44 and a movable light-weight element 46. The fixed element 44 is mounted to the support element 30 and comprises longitudinally extending windings to provide the required magnetic field to move the movable element 46 of the linear motor 42. The linear

element 42 is connected to a plate 48 being guided by the linear bearing 36 and carrying the slide bar 38.

In order to reduce the mass and thus the inertia of the slide bar 38, said bar is preferably made out of a hollow profile 50 carrying vacuum grippers 52 to fixedly engage the printing plate 6. The tubing 54 for the vacuum grippers 52 is preferably provided inside the hollow profile 50 of the slide bar 38.

For properly defining the position of the slide bar 38 along its path of movement, an encoding system 56 is provided at the drive assembly 28. The encoding system 56, for example, may be an inductive or capacitive measurement system. One type suitable for the purpose of the present invention comprises, e.g., a read head RGH22F and a self-adhesive scale RGS-S available from Renishaw UK. Thus, by means of the encoding system 56, the actual position of the slide bar 38 as required by a controller (not shown) at any time can be achieved by the combination of the linear motor 42 and the encoder 56.

The flat bed platesetter system 2 according to the present invention further comprises a bridge 58 traversing the entire width of the flat bed of the platesetter. The bridge 58 movably carries a radiant energy emitting head 60 imaging the printing plate 6. The head 60 is shown in Fig. 5. The source of radiant energy is preferably provided in the head 60. However, it is also possible to conduct the radiant energy from a remote location to the head 60 in order to image the printing plate 6. As shown in Fig. 5, the printing head may comprise several spring-biased rolls 62 pressing the printing plate 6 onto the precision linear bearings 24 in order to precisely define the distance between the radiant energy emitting head 60 and the printing plate 6. These rolls 62 may

be applied in addition to the vacuum ducts 25 or alternatively.

The radiant energy emitting head 60 is movably mounted on the bridge 58 and comprises a drive assembly and encoding system allowing the precise positioning of the head as required for imaging the printing plate 6.

Next, the imaging method according to the present invention will be described with reference to Figs. 6 to 11. Fig. 6 schematically shows a side (Fig. 6a) and top view (Fig. 6b) of the flat bed platesetter system according to the present invention in a start position without any printing plate 6. As shown in said Fig., the system 2 comprises loading, printing and ejection zones. The manual loading zone shown at the most upstream end of the system is optional and may also be an automatic loading zone as described above. Furthermore, the flat bed of the platesetter system according to the present invention is inclined in a direction of movement 10 of the printing plate 6 so as to allow movement of the printing plate by means of gravitational force which can be obtained by means of the low friction of the roller bearings supporting the plate.

As already previously described, a continuous imaging method can be carried out with the platesetter system 2 of the present invention. The imaging method of a printing plate 6 will now be described. The printing plate is provided by the storage and delivery system 14, e.g., by pivoting a delivery plate of the system 14 as indicated by arrow 63 in Fig. 6 so as to cause the printing plate 6 to move against stop means 64 provided at the upstream end 12 of the support area 4 (shown in Fig. 8). As shown in Fig. 8, the stop elements 64 are removed, e.g., vertically along arrow 66. Consequently, the

printing plate 6 moves because of the gravitational force onto the support area 4 until its front end reaches the stop members 20 which are meanwhile present at the downstream end 22 of the support area 4. Then, the laterally located positioning elements 16 and 18 move along arrows 68 and 70 towards each other to properly centre and position the printing plate 6 on the support area 4 so that its longitudinal axis is substantially parallel to the path of the printing plate driver slide 28.

As shown in Fig. 9, the slide bar 38 of the drive assembly 28 now returns from a previously driven printing plate 6' along arrow 72 in its position beneath the printing plate 6 and the support area 4. The image printing plate 6' may then be automatically or manually transported from the ejection zone.

Now the vacuum grippers 52 of the slide bar 38 engage the printing plate 6, and the position element 16 and 18 as well as the stop elements 20 release the printing plate as it is now precisely held on the drive assembly 28. At this state of the procedure, the next printing plate 6" (Fig. 10) may already be provided by the storage and delivery system 14 as shown in Figs. 10 and 11. However, it has to be held back from the support area 4 by the stop elements 64. The printing plate 6 to be imaged is now fed along the direction of movement 10 beneath the radiant energy emitting head 60, which transversely moves along the bridge 58 to provide the desired images on the printing plate 6. After completion of the imaging method, the next printing plate 6" (Fig. 10) to be imaged is fed to the support area 4 and the above-described imaging method may be repeated again.

The ejection zone receiving the imaged printing plate 6 preferably essentially corresponds to the support area 4 described above.

Although the flat bed platesetter system 2 according to the present invention has been described as being inclined, it is also possible to provide it in a horizontal plane and provide further drive mechanisms to transport the printing plate 6.

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CLAIMS

1. A flat bed platesetter system (2) for imaging radiant energy onto a printing plate (6), the system comprising:

   (a) drive means (28) for moving the printing plate (6) in a direction of movement (10);

   (b) at least one low inertia carriage member (38) effectively connecting the printing plate (6) and the drive means (28); and

   (c) an optical head (60) being movably mounted on a stationary bridge (58) extending across the direction of movement (10) of the printing plate (6) and being provided for emitting radiant energy onto the printing plate (6).

2. A flat bed platesetter system (2) for imaging radiant energy onto a printing plate (6), the system comprising:

   (a) an optical head (60) being movably mounted on a stationary bridge (58) extending across a direction of movement (10) of the printing plate (6); and

   (b) a radiant energy emitting source being provided at or in the optical head (60) for emitting radiant energy onto the printing plate (6).

3. A flat bed platesetter system (2) for imaging radiant energy onto a printing plate (6), the system comprising:

(a) drive means (28) for moving the printing plate (6) in a direction of movement (10);

~~(b) support means (32) supporting the flat bed platesetter~~ system (2) in a downwardly inclined manner with respect to the direction of movement (10) of the printing plate (6); and

(c) optionally a storing and delivery system (14) for a plurality of printing plates (6) having a support and delivery area which is downwardly inclined or inclinable in order to feed a printing plate (6) by means of the gravitational force onto a support area (4) of the flat bed platesetter.

4. A flat bed platesetter system (2) for imaging radiant energy onto a printing plate (6), the system comprising:

(a) drive means (28) for moving the printing plate (6) in a direction of movement (10;

(b) an optical head (60) being movably mounted on a stationary bridge (58) extending across the direction of movement (10) of the printing plate (6) and being provided for emitting radiant energy onto the printing plate (6); and

(c) printing plate positioning means for bringing the printing plate (6) into a defined and precisely centred position onto a support area (4) prior to imaging, wherein a first positioning element (18) is provided at a first lateral side, second a third positioning elements (16) are provided at the opposite, second lateral side, and at least a fourth

positioning element (20) is provided at a downstream end (22) of the support area (4).

5. A flat bed platesetter system (2) for imaging radiant energy onto a printing plate (6), the system comprising:

(a) a support area (4) movably supporting the printing plate (6) in a direction of movement (10);

(b) an optical head (60) being movably mounted on a stationary bridge (58) extending across the direction of movement (10) of the printing plate (6) and being provided for emitting radiant energy onto the printing plate (6); and

(c) a drive assembly effectively connecting the printing plate (6) and drive means (28), the drive assembly including:

- a carriage member (38) carrying the printing plate (6) and being mounted on at least one linear bearing (36);

- an electric linear motor (22) driving the carriage member (38); and

- an encoding system (56) for properly defining the position of the carriage member (38) along its path of movement (10).

6. A flat bed platesetter system (2) for imaging radiant energy onto a printing plate (6), the system comprising:

(a) drive means (28) for moving the printing plate (6) in a direction of movement (10);

(b) a carriage member (38) effectively connecting the printing plate (6) and the drive means (28), wherein the carriage member (38) is provided in a centre position of a support area (4) supporting the printing plate (6).

7. A flat bed platesetter system (2) according to a combination of any of claims 1 to 6.

8. The system of any of claims 1 to 7, further comprising linear bearing means (8, 24) for movably supporting the printing plate (6) in the direction of movement (10).

9. The system of any of claims 1 to 8, wherein the printing plate (6) comprises a thermosensitive or photosensitive material.

10. The system of any of claims 1 to 9, wherein the head (60) comprises a spatial modulator being illuminated by at least one laser emitter and an optic forming the image of the modulator onto the printing plate level.

11. The system of claim 10, wherein the head (60) comprises the laser emitters.

12. The system of any of claims 1 to 11, wherein the drive means (28) is an electric linear motor (42) having its longitudinally moving element (46) mounted to the carriage member (38).

13. The system of any of claims 1 to 12, wherein the carriage member (38) is supportingly guided by at least one linear bearing (36).

14. The system of any of claims 1 to 13, wherein the carriage member (38) comprises at least one vacuum gripper (52) holding the printing plate (6).

15. The system of any of claims 1 to 14, wherein the carriage member (38) is located in the middle of the width of the flat bed.

16. The system of any of claims 1 to 15, being arranged inclined in the direction of movement (10) of the printing plate (6).

17. The system of any of claims 1 to 16, further comprising printing plate positioning means (16, 18, 20) for bringing the printing plate (6) into a defined and precisely centred position prior to imaging.

18. The system of claim 17, wherein the printing plate positioning means comprise at least one positioning element (16, 18) provided respectively laterally of a support area (4) and at least one positioning element (20) provided at an downstream end (22) of the support area (4).

19. The system of claim 18, wherein a first positioning element (18) is provided at a first lateral side, second and third positioning elements (16) are provided at the other, second lateral side, and a fourth positioning element (20) is provided at the downstream end (22) of the support area (4).

20. The system of claim 18 or 19, wherein at least one of the positioning elements (16, 18, 20) is movable.

21. The system of any of claims 1 to 20, further comprising an encoding system (56) for properly defining the position of the carriage member (38) along its path of movement (10).

22. Method for imaging a printing plate (6) with radiant energy in a flat bed platesetter, particularly according to any of claims 1 to 21, comprising the steps of:

(a) providing a printing plate (6) on a support area (4) of the flat bed platesetter;

(b) positioning the printing plate (6) on the support area (4);

(c) moving the printing plate (6) in a first direction (10); and

(d) moving a radiant energy emitting head (60) in a second direction substantially perpendicular to the first direction (10) in order to provide an image on the printing plate (6).

ABSTRACT

Flat bed platesetter system and method for its use

The present invention provides a flat bed platesetter system and a method for its use, particularly for imaging printing plates. For providing a precise, continuous, rapid and format-independent system which is reliable, the present invention suggests to move the printing plate relative to a stationary bridge carrying a radiant energy emitting head by means of a low inertia carriage member effectively connecting the printing plate and drive means.

(Fig. 1)

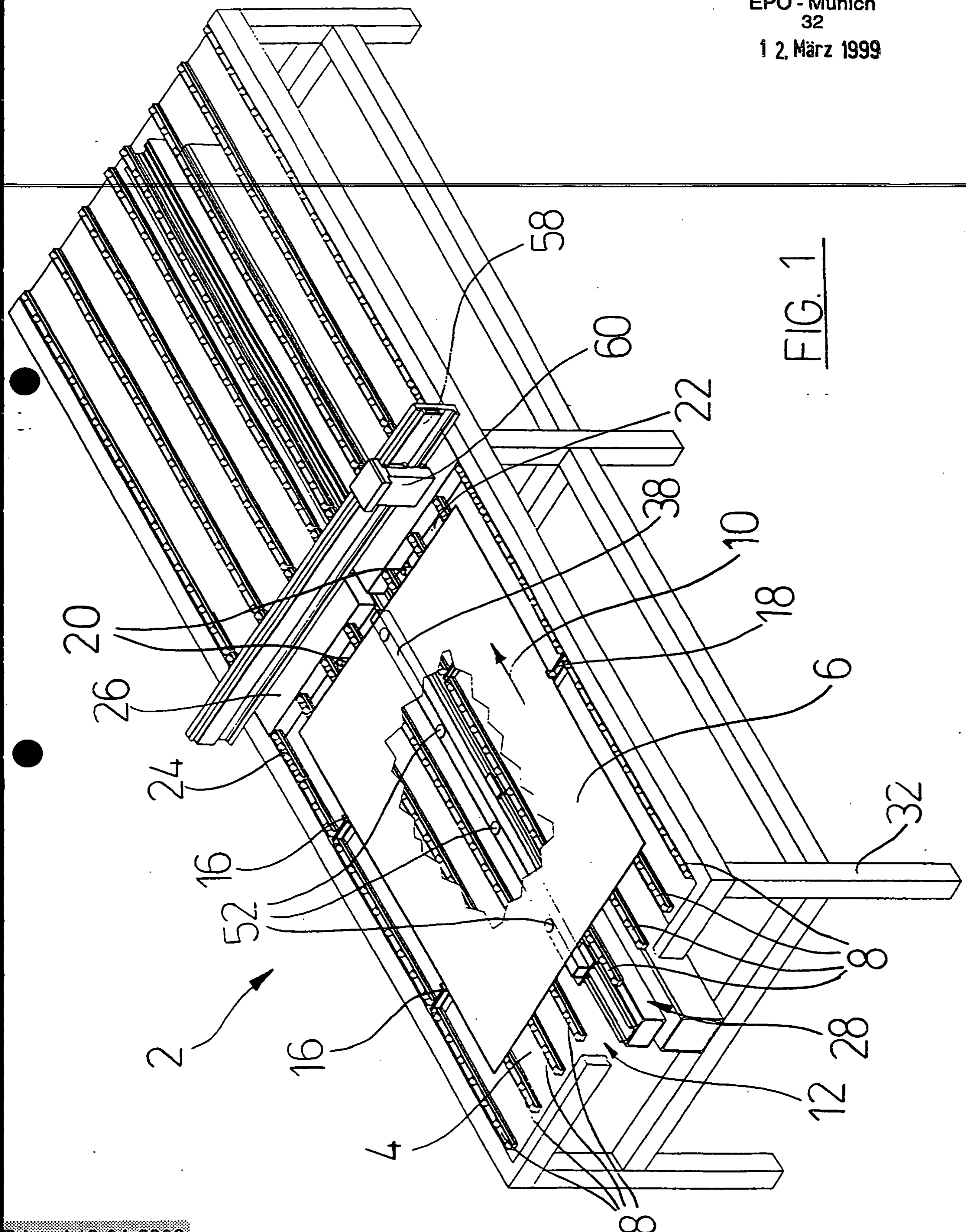


FIG. 1

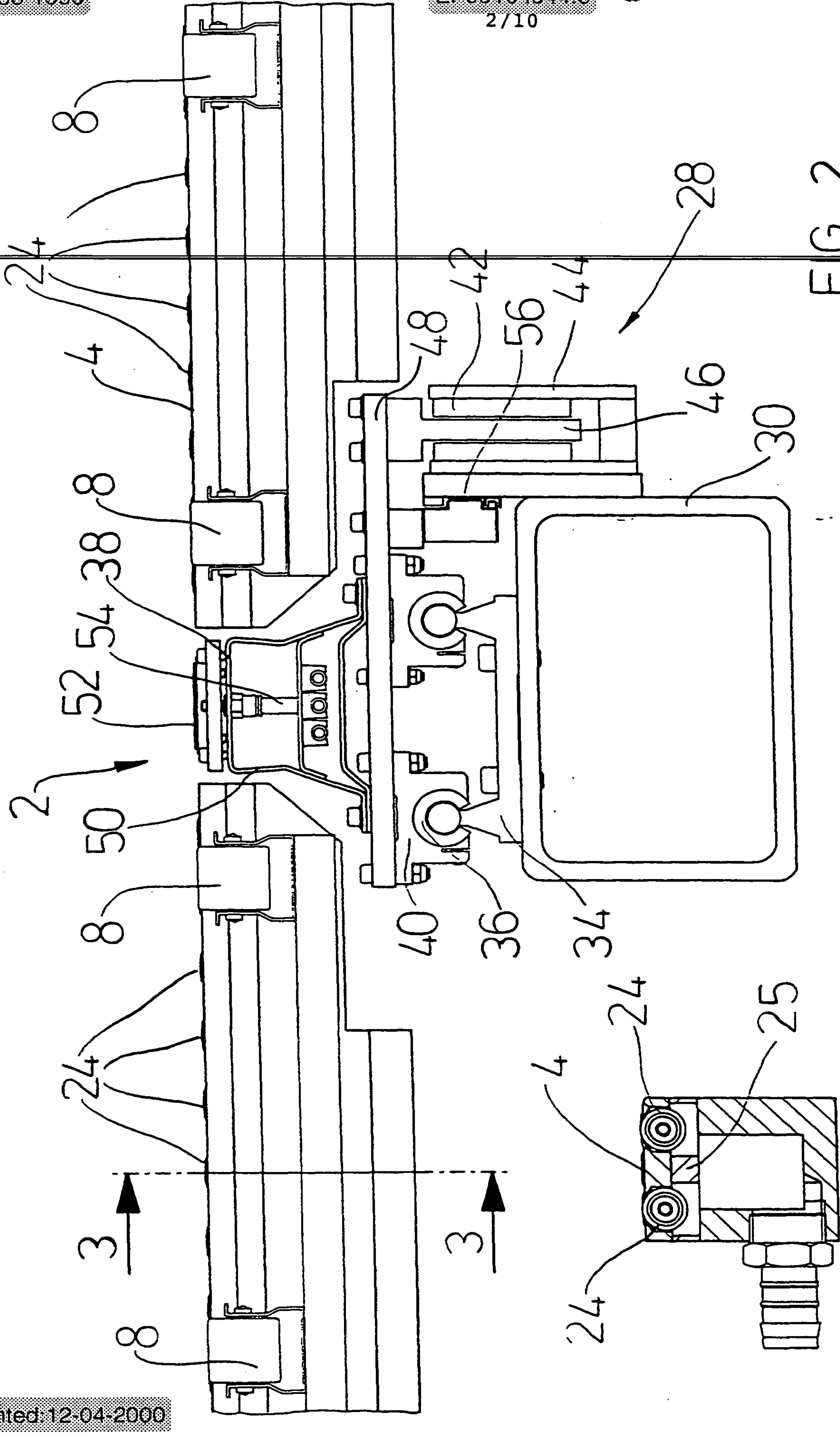


FIG. 2

FIG. 3

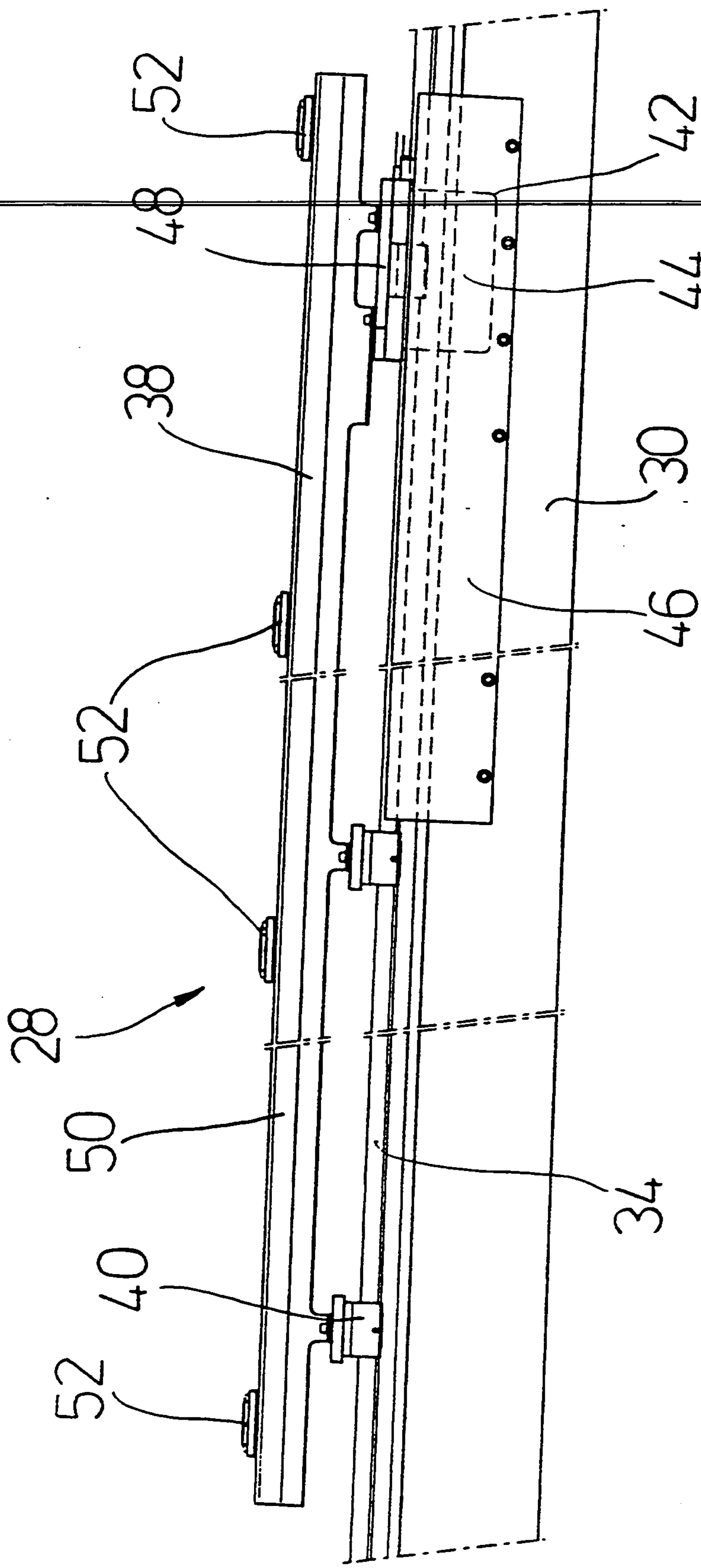


FIG. 4

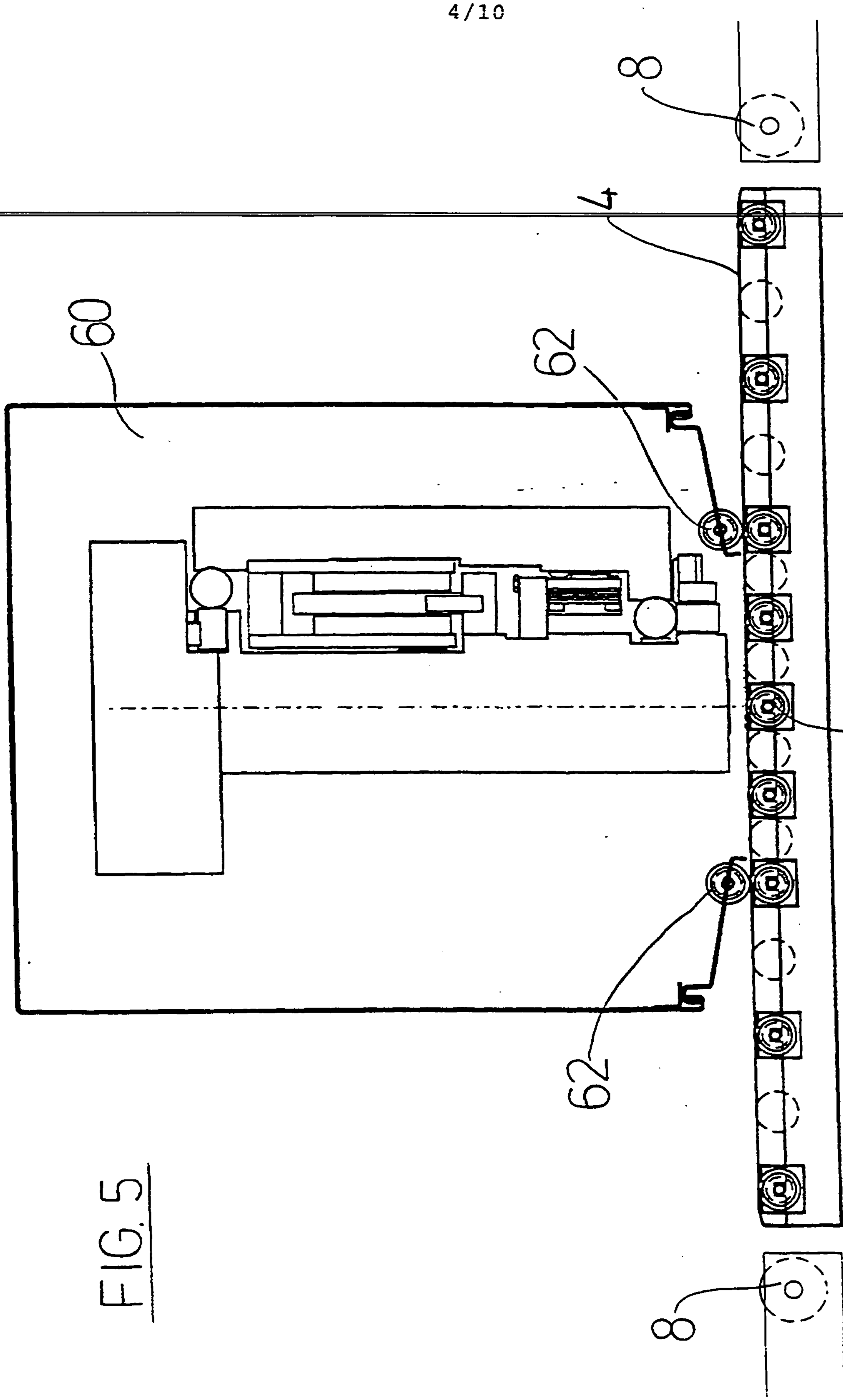
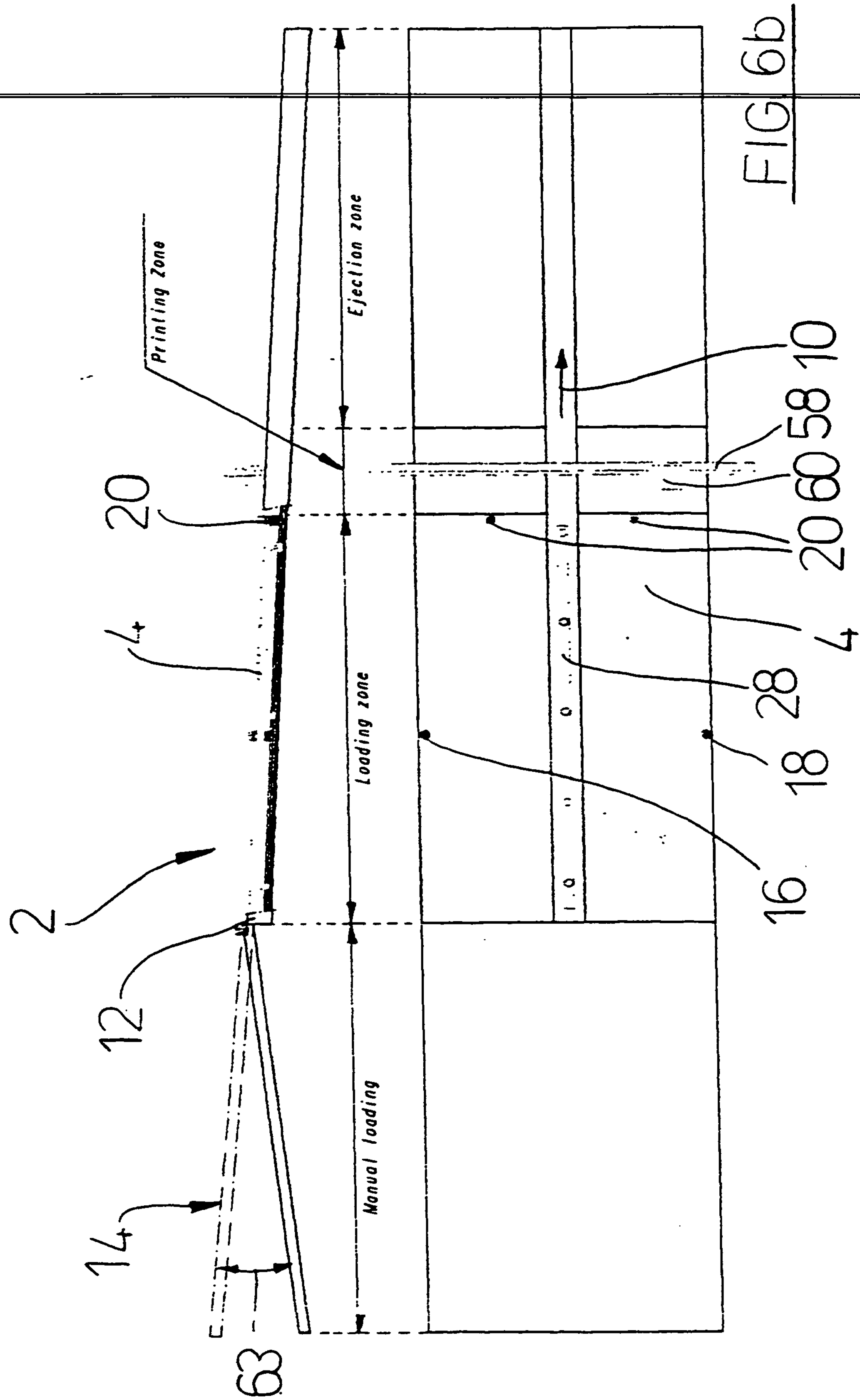


FIG.5



Printing Zone
Ejection zone
Loading zone
Manual loading
2
4
12
14
20
63
10
58
60
20
4
28
18
16

FIG. 6a

FIG. 6b

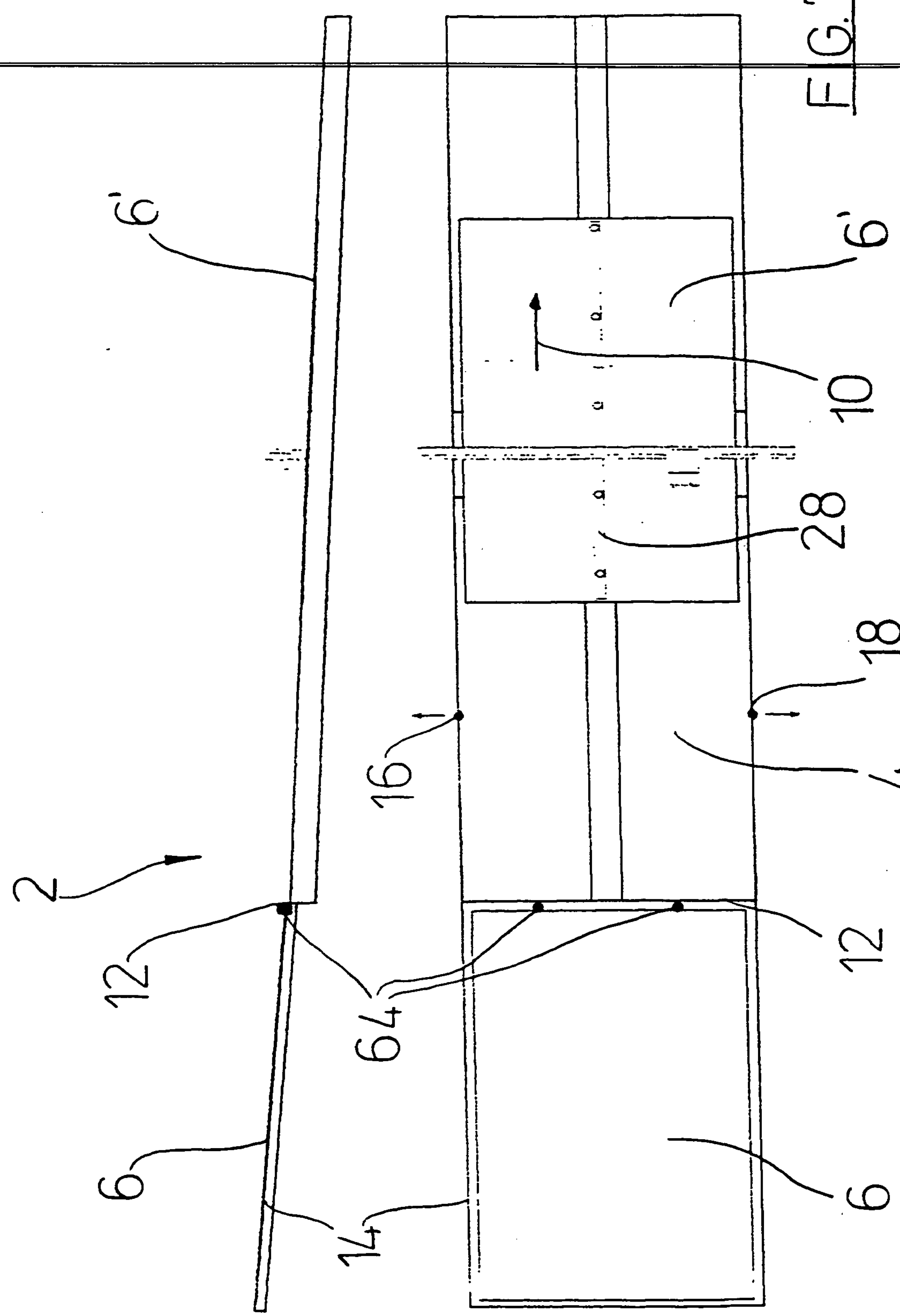


FIG. 7a

FIG. 7b

FIG. 8a

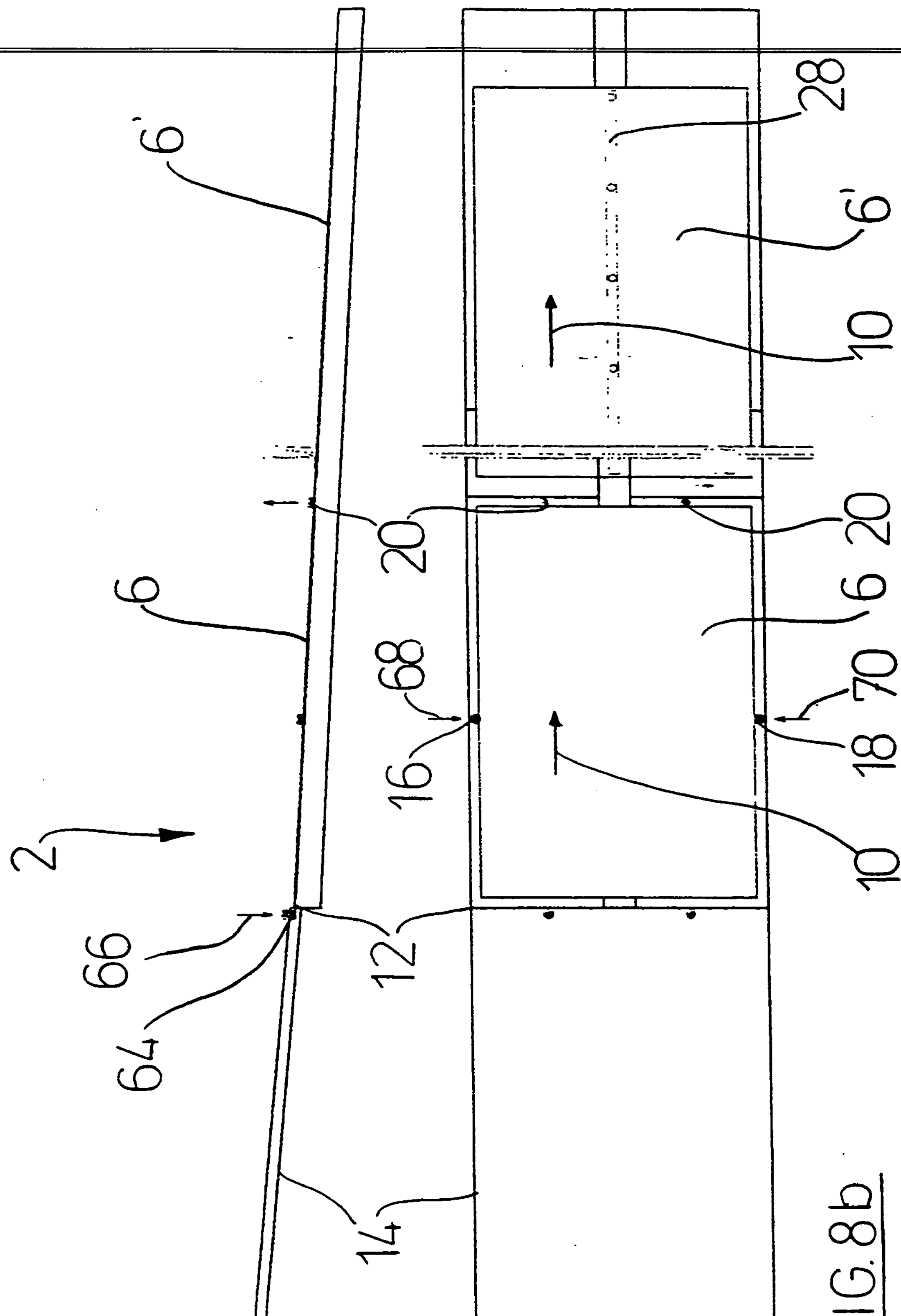


FIG.8b

FIG. 9a

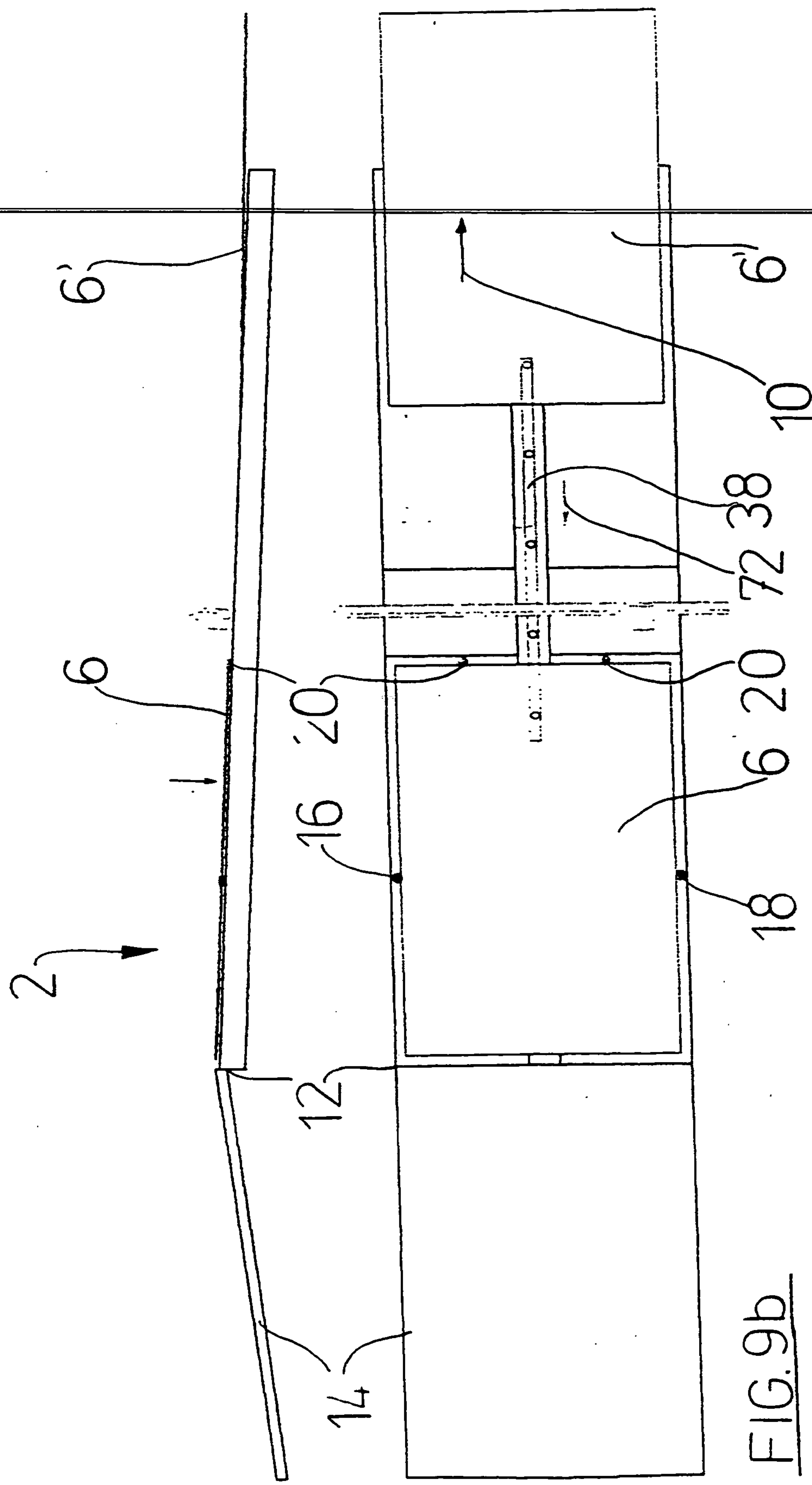


FIG. 9b

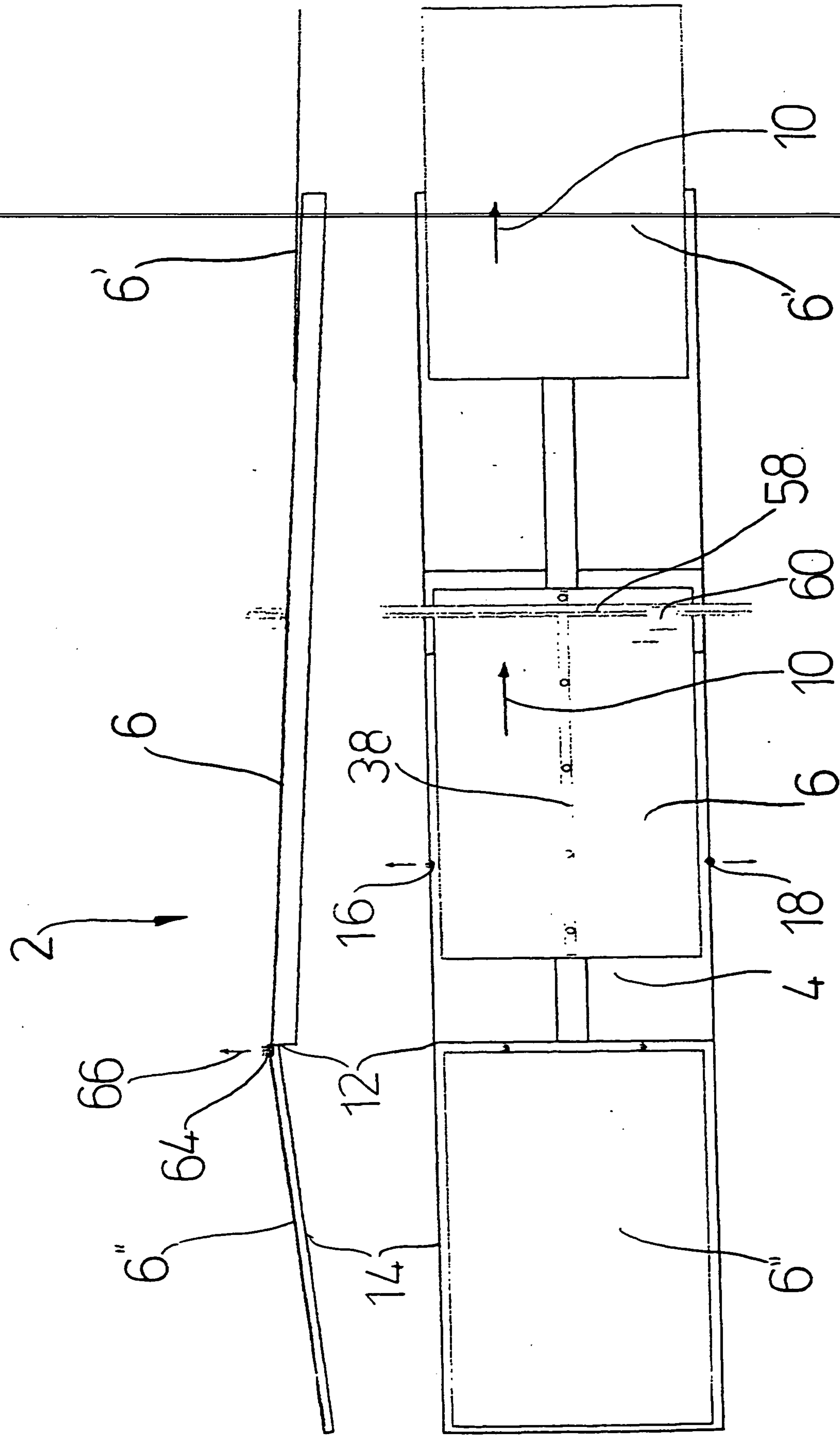


FIG. 10a

FIG. 10b

FIG. 11a

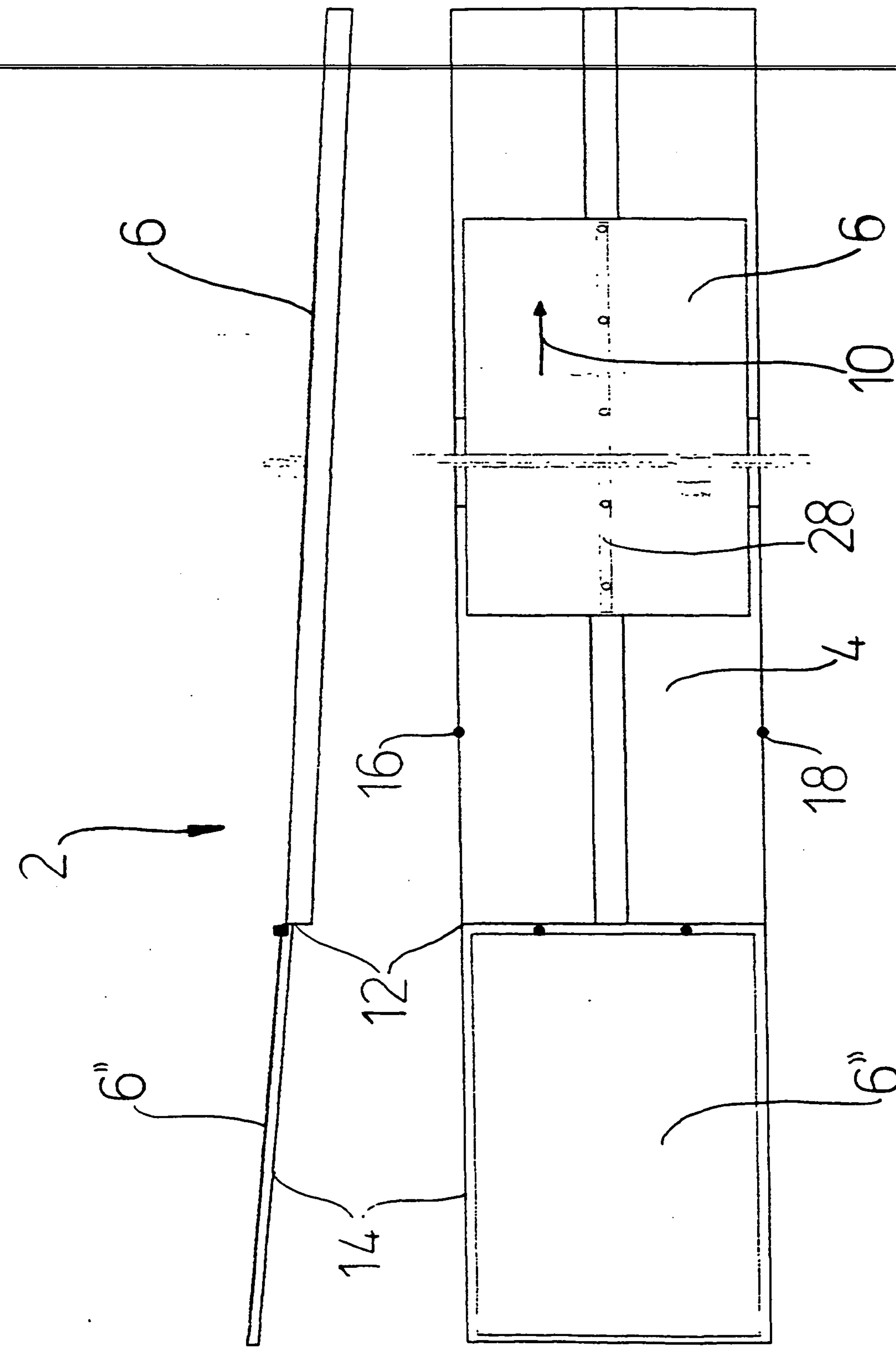


FIG. 11b